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The Suitability of Thoraco-abdominal Aortic Aneurysms for Branched or Fenestrated Stent Grafts — And the Development of a New Scoring Method to Aid Case Assessment

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Abstract *Objective:* To determine the proportion of TAAAs which might be suitable for pure endovascular repair based on aneurysm morphology and to develop an MDCTA based scoring system to grade case complexity.
Design: 70 consecutive MDCTA of patients with TAAAs were analysed in relation to specific morphological characteristics.
Methods: The characteristics included potential stent landing zone lengths, arch angulation, thoraco-abdominal aorta angulation, branch vessel origin stenosis, access tortuosity/diameter and aortic dissection.
Results: 60% of TAAAs would be suitable for branched/fenestrated stent grafting but 40% are unsuitable due to adverse anatomy. 27% had an aortic arch angulation of $\leq 110°$ and 24% had descending thoracic aorta angulation of $\leq 90°$. Significant ostial stenosis was identified in 31% of celiac arteries, 7% superior mesenteric arteries, 24% left renal artery and 19% right renal arteries. 11% of left common iliac and 7% right common iliac arteries had angulation of $\leq 70°$.
There were 26 cases with aortic dissection and 54% of these had a true lumen of ≤ 26 mm.
Conclusion: Successful fenestrated/branched stent graft repair of TAAAs requires adequate landing zones, cannulation of visceral arteries and suitable diameter access vessels. 60% of TAAAs

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studied were suitable for branched/fenestrated stent graft repair but 40% of TAAAs were unsuitable; aortic angulation, visceral vessel ostial stenosis and dissection true lumen diameter were the principle issues. Development in stent technology may address these anatomical challenges.

Introduction

The incidence of thoraco-abdominal aneurysms is lower at 6 per 100, 000 person years[1] but the mortality from rupture is high at 5–100%.[2,3] Traditionally the mortality of open repair of thoraco-abdominal aneurysms has been variable, latest reports ranging from 5 to 35%.[4–8]

The advent of the endoluminal approach to vascular surgery has transformed the management of thoraco-abdominal aneurysm disease. Endovascular treatment of complex thoroco-abdominal aneurysms either with a combined Hybrid/Octopus technique,[9–13] or total endovascular approach using branched/fenestrated grafts is a well recognised,[14–24] but developing option to open surgical repair of TAAA.

There are two main technical issues relating to the endovascular treatment of these aneurysms. The first is to achieve adequate seals at the proximal and distal landing zones. The second is to achieve safe cannulation and stenting of all the involved visceral vessels whilst preserving organ perfusion.

The aims of this study were to 1. Determine the proportion of TAAAs which might be suitable for pure endovascular repair i.e.: fenestrated or branched stent grafting, based on aneurysm morphology and 2. Develop an MDCTA based scoring system to grade case complexity.

Methods

Patient population

We identified thoraco-abdominal aneurysm cases which had presented either as emergencies (hospital-to-hospital transfer or to our A&E), or elective referrals to our institution from October 2001–April 2006. In all cases the patients included underwent multidetector computed tomography angiography (MDCTA) (Phillips Brilliance Extended Workspace CT 16-slice, Eindhoven, The Netherlands) of the thoroco-abdominal aorta as part of the normal pre-operative workup in our unit. We analysed the anatomical and morphological characteristics of the MDCTA images to determine the suitability for endovascular repair.

Analysis of anatomical suitability for endovascular repair

The thoraco-abdominal aneurysms of our study cases were classified in accordance with the Crawford classification.

The morphological suitability of each MDCTA for endovascular repair was analysed retrospectively. The analysis assessed characteristics of both the aorta and the visceral vessels. The assessment was performed on a Philips Brilliance Extended Workspace workstation using the central line measurements. We developed a scoring system to quantify the degree of difficulty if the case were to be wholly treated by endovascular means. Each case included in our study was broken into 14 'components', which comprised vessels assessed (9 components-left subclavian artery, celiac axis, superior mesenteric artery, right and left renal arteries, common iliac arteries and external iliac arteries), length of proximal and distal landing zones (2 components), degree of arch and thoraco-abdominal angulation (2 components), and presence or absence of dissection (1 component). The dissections were also sub-analysed.

Table 1 below shows the components analysed.

The diagrams below demonstrate how some of the key angulation measurements have been taken (Figs. 1 and 2).

Each component was then allocated a 'difficulty score' according to its features, e.g. stenosis of the superior mesenteric artery of more than 50% would in all probability cause difficulty in cannulation for a fenestrated/branched graft, even in experienced hands.

Each component was allocated a score of 0 or 1 e.g. SMA origin stenosis of greater than 50% was allocated a score of 1 and a stenosis of less than 50% was allocated a score of 0.

Table 1 Components analysed.

Component	Characteristics measured	Difficulty
Proximal landing zone	Length (centimetres)	<1.5 cm = difficult
Distal landing zone	Length (centimetres)	<1.5 cm = difficult
Aortic arch	Angulation (degrees)	≤110° = difficult
Thoraco-abdominal aorta angulation	Angulation (degrees)	≤90° = difficult
Left subclavian artery	Origin stenosis (%)	≥50% = difficult
Celiac axis	Origin stenosis (%)	
Superior mesenteric artery	Origin stenosis (%)	
Left/Right renal artery	Origin stenosis (%)	
Left/Right common iliac artery	Tortuosity (degrees)	≤70° = difficult
Left/Right external iliac artery	Diameter (mm)	≤7 mm = difficult

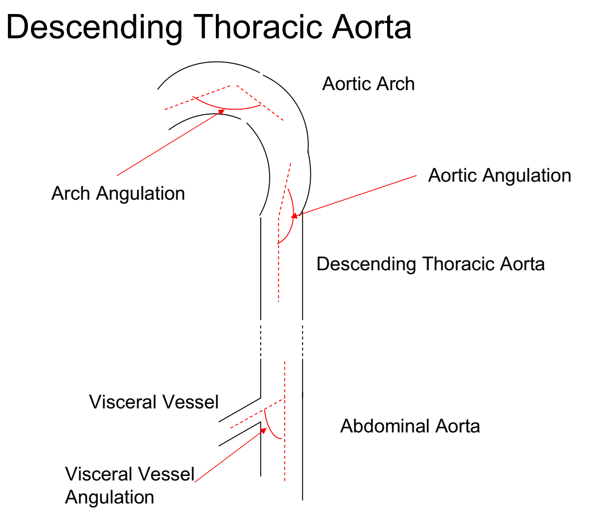

Figure 1 Diagrammatic representation of aortic arch, descending thoracic aorta, abdominal aorta and visceral vessel to illustrate angulation measurement technique.

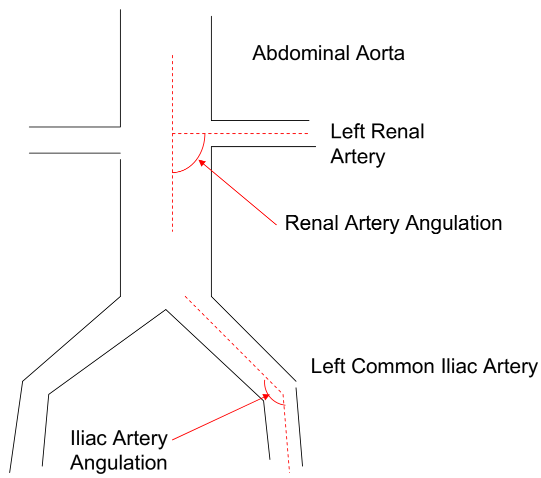

Figure 2 Diagrammatic representation of abdominal aorta and common iliac artery to illustrate angulation measurement technique.

The iliac vessels scored 0 for diameter >7 mm access and 1 for small diameter ≤7 mm. The sum of these scores was collated to achieve the overall score for the case.

It is of course possible to deal with individual components which are technically challenging. However, we would consider cases with 3 or less adverse anatomical features as difficult but 'do-able', and cases with >3 adverse anatomical components (i.e. a score of 4), as extremely difficult or unsuitable for fenestrated/branched using current technology.

The scoring of the components is set out in Table 2.

Patients with dissection were sub-analysed. We considered the following features to each render the case unsuitable for endovascular repair: true lumen diameter of <26 mm at or within 5 cm from the visceral arteries, origin of SMA from the false lumen, 2 or more vessels originating from the false lumen and CIA diameter of >24 mm. These features are set out in Table 3.

Results

Patient group

From October 2001–April 2006, 104 consecutive patients presented as emergency or electively to our institution for TAAA treatment. Those with incomplete imaging were excluded, resulting in a study group of 70 patients. However, when we collected additional data for the subanalysis of the dissection cases, 2 cases were inaccessible (due to corrupted optical disc). The total study group therefore comprised 70 patients but only 24 of the 26 dissections could be sub-analysed.

The consort diagram below illustrates the patient numbers (Fig. 3).

Demographics and crawford classification of the study group

The mean age of the patient group was 69 years (range 39–84 years), median 71 years, comprising 43 males and 27 females.

The thoraco-abdominal aneurysms were classified in accordance with the Crawford classification. There were 12 type I, 37 type II, 14 type III and 7 type IV. There were 26 dissections. These features of the group are shown in Table 4.

The proximal and the distal landing zones length and aortic arch angulation

The proximal landing zones were analysed covering the origin of the left subclavian artery (LSCA) where necessary.

Table 2 Scoring of components.

Component	Characteristics measured	Difficulty	Score (1 = difficult)
Proximal landing zone	Length (centimetres)	<1.5 cm = difficult	0–1
Distal landing zone	Length (centimetres)	<1.5 cm = difficult	0–1
Aortic arch	Angulation (degrees)	≤110° = difficult	0–1
Thoraco-abdominal aorta angulation	Angulation (degrees)	≤90° = difficult	0–1
Left subclavian artery	Origin stenosis (%)	≥50% = difficult	0–1
Celiac axis	Origin stenosis (%)		0–1
Superior mesenteric artery	Origin stenosis (%)		0–1
Left/Right renal artery	Origin stenosis (%)		0–1
Left/Right common iliac artery	Tortuosity (degrees)	≤70° = difficult	0–1
Left/Right external iliac artery	Diameter (mm)	≤7 mm = difficult	0–1

Table 3 Features of dissections affecting EVAR suitability.

	Possible	Not possible	Reason
True Lumen Diameter	≥26 mm	<26 mm	No enough room for the fenestration or branch to open
SMA origin	True Lumen	False Lumen	Stenting true lumen means occlusion of SMA or the side vessel
Visceral origin	<2 from False lumen	>2 from False lumen	Stenting true lumen means occlusion of visceral vessels
Commom Iliacs Diameter	≤24 mm	>24 mm	Current stent sizes prevent adequate seal

Short landing zones (<1.5 cm) were encountered in 1 of 70 patients (1%). Of those cases considered to have landing zones of ≥1.5 cm, the LSCA would need to be covered in 12 cases.

Difficult arch angulation ≤110° (acute angulation between the long axis of the arch and descending arch) was encountered in 19 cases (27%), of which 7 were also dissection cases.

The distal landing zones were also assessed and considered difficult if less than 1.5 cm in length (Fig. 4). 4 (6%) of cases had a short distal landing zone. None of these were dissection cases, but there was 1 occluded distal aorta (Fig. 5).

The descending thoracic aorta and left subclavian artery

The descending thoracic aorta was found to have angulation of ≤90° (Fig. 6) in 17 cases (24%), with 15 of these cases having a double bend and 9 of these cases being dissections. In those cases with the angulation of the descending thoracic aorta >90°, there were 18 cases with a double bend. A total of 33 cases (47%) were tortuous with a double bend.

The origin stenosis of the LSCA was assessed and we found the LSCA to have an origin stenosis of ≥50% in only 5 (7%) of cases, of which 3 were dissections.

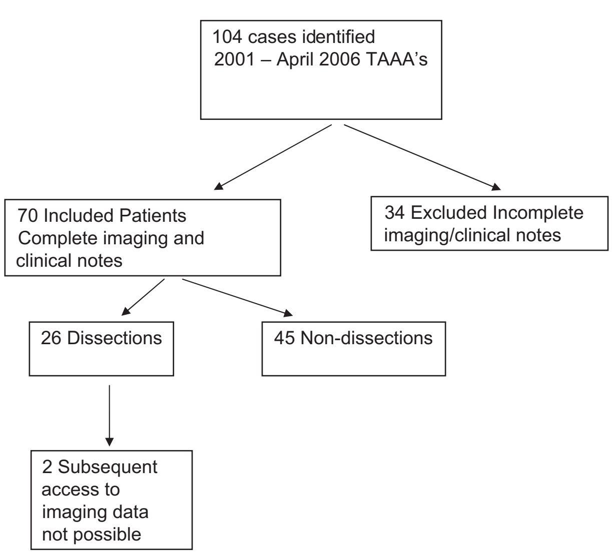

Figure 3 Consort diagram.

The visceral vessels

The origin stenosis of the visceral arteries was assessed, and origin stenosis ≥50% considered to be technically challenging for vessel cannulation and stenting for branch grafting/fenestrated stent grafting. 22 (31%) of celiac arteries (CA) (Figs. 7 and 8), of which 3 were in dissection cases, had ostial stenosis ≥50%. 5 (7%) of superior mesenteric arteries had stenoses ≥50% (Fig. 8), none of which were dissections.

17 cases had ≥50% stenosis of the left renal artery (Fig. 9), 6 of these in dissection cases and additionally 2 sets of double vessels. 15 (19%) of right renal arteries were stenosed, of which 5 were dissections and 5 sets of double vessels.

The common iliacs

Common Iliac Arteries were assessed for tortuosity and an angle of ≤70° deemed to be significant. 8 (11%) left common iliacs were tortuous (Figs. 10 and 11) and 3 of these were in dissection cases. In addition there were 5 double angles in this group and a total of 15 in the entire group, 1 vessel was completely occluded and could not be assessed for tortuosity and 1 non tortuous vessel was partially thrombosed. 5 (7%) right common iliacs were tortuous and 1 of these was in a dissection case. In addition there were 3 double angles in this group and a total of 9 in the entire group, 1 vessel was completely occluded and could not be assessed for tortuosity and this was the same case as the occluded left iliac and occluded aorta.

Table 4 Demographics and crawford classification distribution of study group.

Demographics and Crawford Classification Distribution of Study Group (n = 70)		
Sex	Male = 43	Female = 27
Age	Range 39–84 years	Mean 71 years
Crawford Type	I = 12	
	II = 37	
	III = 14	
	IV = 7	
No. of Dissections	26	

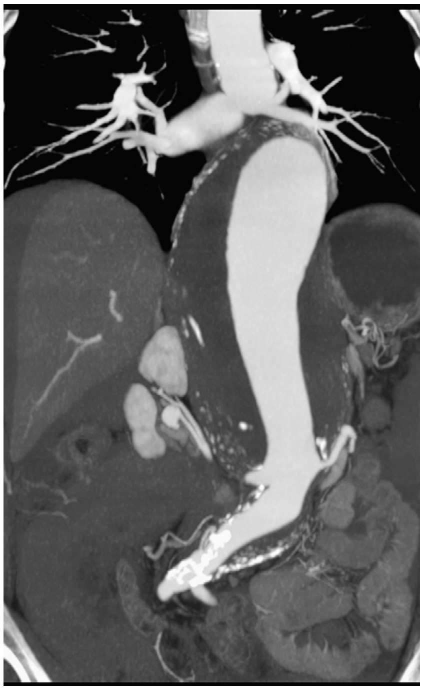

Figure 4 MDCTA images of short distal landing zone.

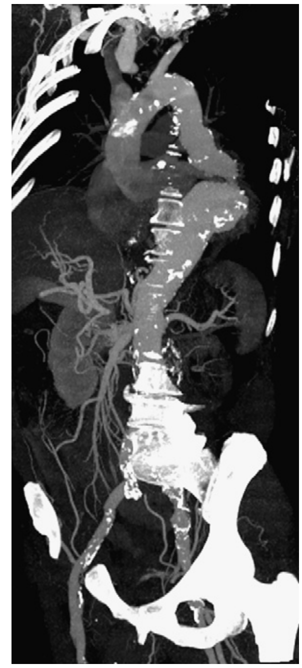

Figure 6 MDCTA images of tortuous descending thoracic aorta and arch (severe angulation).

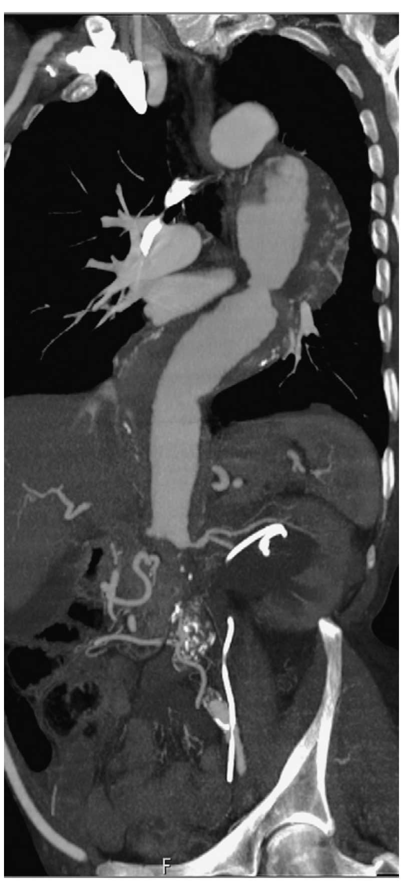

Figure 5 MDCTA images of occluded aorta.

Figure 7 MDCTA images of celiac artery stenosis.

Figure 8 MDCTA images of superior mesenteric and celiac artery stenosis.

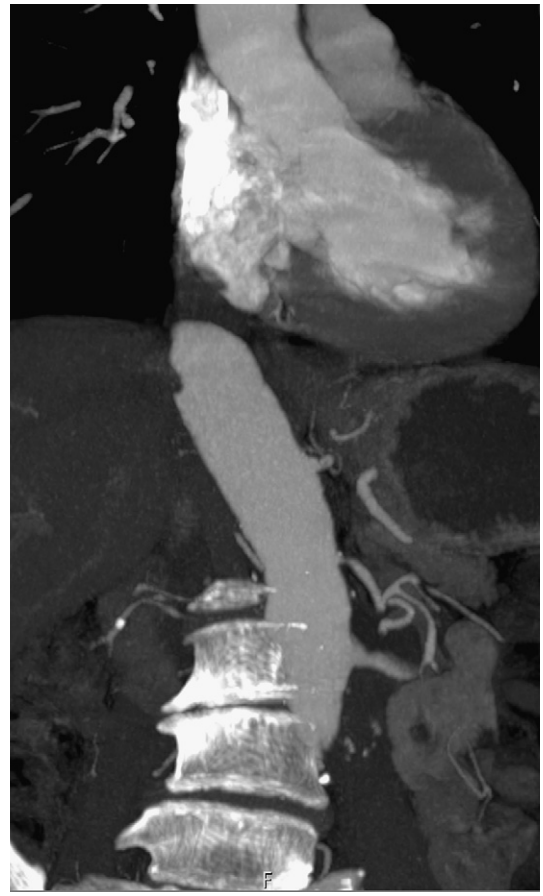

Figure 9 MDCTA images of left renal artery stenosis.

The external iliac diameter

The external iliac arteries (access vessels) were assessed in terms of diameter, with a diameter of $\leq$7 mm difficult (Fig. 12). Only 9 (13%) of cases had small left external iliac vessels (no dissections) and 10(14%) had small right external iliacs (1 dissection).

All these results are summarised in Table 5.

The scoring

As described each component was allocated a 'difficulty score' of 0 or 1. The sum of these scores was collated to achieve the overall score for the case. A difficult component in isolation does not render a case unsuitable for fEVAR, but more than 3 such difficult components probably do. Therefore we considered cases with scores of 4 to be extremely difficult or unsuitable for fEVAR. The scoring components utilised are set out in Tables 1 and 2 the results in Table 6.

On the basis of this scoring system 13% ($n = 9$) of cases would have been excluded, 2 of which were dissections, prior to any dissection subanalysis i.e. 2 of the cases which were dissections were excluded with the overall scoring system before we looked at the features of the dissection morphology we considered to pose additional difficulty.

There were some relevant additional features which were not part of the scoring system. Of the 12 cases which scored 0, 5 had double descending thoracic aorta angulation of $>90^\circ$, 2 of these cases also had bilateral CIAs with double angles ($>70^\circ$), and 1 other case had RCIA with double angles $>70^\circ$. Overall 58% of these cases were dissections.

There were 20 cases which scored 1, 7 of which had double angulation of the descending thoracic aorta (2 with angles $>90^\circ$, 5 with angles $\leq 90^\circ$). 1 of these also had bilateral CIAs with double angles (right CIA $\leq 70^\circ$ and the left $>70^\circ$) and 1 also had tortuous EIAS. Two further cases had bilateral CIAs with double angles (one both CIAS $>70^\circ$ and one the right $\leq 70^\circ$), 2 had left CIAs with double angles (1 $> 70^\circ$ and 1 $\leq 70^\circ$). Overall 35% of these cases were dissections. There were 14 cases scoring 2, of which 50% were dissections. 7 of these cases had double angulation of the descending thoracic aorta (3 $> 90^\circ$ and 4 $\leq 90^\circ$). One of those with acute angles also had a left CIA with double angles (1 $> 70^\circ$ and 1 $\leq 70^\circ$), and one a double angle of the left CIA ($>70^\circ$). 1 case with non-acute angles also had a left CIA with double angles and this was also $\leq 70^\circ$. There was 1 case with a double angle in the right CIA $>70^\circ$.

15 cases scored 3 and 20% of these were dissections. In this group, 2 cases had double angles of the left CIA (one $\leq 70^\circ$ and one $>70^\circ$), and 1 case had occlusion of the aorta and both iliacs. There were also 9 cases with double angulation of the descending thoracic aorta (4 cases with

Figure 10 MDCTA images of tortuous common iliac vessels.

Figure 11 MDCTA images of tortuous common iliac vessels.

angles $>90°$ and $5 \leq 90°$). One of the cases with a non-acute angle also had bilateral CIAs with double angles (left CIA $\leq 70°$ and right $>70°$), and 1 case with a double angle of the left CIA ($\leq 70°$). Of the 5 cases with acute thoracic angulation, 1 also had a partially thrombosed left CIA and 1 had bilateral aneurysmal CIAs with a double angle of the right CIA ($\leq 70°$).

There were 5 cases scoring 4, 40% with dissection. Three of these had double angulation of the descending thoracic aorta (all $>90°$), 1 with an additional double angle of the right CIA ($>70°$). One further case had double angles of the left CIA ($\leq 70°$).

There was 1 patient who scored 5 and this patient had double angulation of the descending thoracic aorta ($\leq 90°$). 2 cases achieved a score of 6, both having double angulation of the descending thoracic aorta one of which was acute ($\leq 90°$). The other case was non-acute ($>90°$) and also had bilateral CIAs with double angles (right $\leq 70°$). Finally 1 case scored 7, and this also had an aneurysmal left CIA with an angulation of $\leq 70°$. There were no dissections scoring 5, 6 or 7.

The dissection subanalysis

Patients with dissection were sub-analysed as outlined in the Methods and illustrated in Table 7. Unfortunately we were only able to subanalyse 24 of the 26 dissection cases due to problems retrieving the imaging data when revisited.

14 were excluded as the true lumen was ≤ 26 mm at or within 5 cm of the visceral arteries, 3 of which also had > 2 viscerals arising from the false lumen. 6 were excluded because the SMA arose from the false lumen (in 4 false lumen only and in 2 from both true and false lumens) and 1 of these also had small true lumen diameter. 3 were excluded as >2 viscerals arose from the false lumen (1 of which also had small true lumen and 1 had small true lumen with the SMA arising from the false lumen).

4 cases had CIAs greater than 24 mm, but only 1 of these was bilateral. The bilateral case had a small true lumen. In 2 of the unilateral cases, the SMA arose from the false lumen. The remaining unilaterally large CIA case had no other excluding features in relation to the dissection subanalysis and scored a 3 but this is the case with an occluded, aorta and iliacs so would probably be considered too difficult despite not being excluded by the scoring or subanalysis. Overall we would have excluded 20 dissections.

There were 4 remaining cases considered suitable after the dissection subanalysis. These cases scored 0, 0 (with double thoracic angulation $>90°$), 2 with double thoracic angulation $>90°$, and 2 and would not have been excluded by the scoring either.

Of the 2 cases we were unable to subanalyse, one scored a 1 with double thoracic angulation $\leq 90°$ and the other scored a 3

Figure 12 MDCTA images of small diameter external iliac arteries.

with double thoracic angulations $\leq$90° and a partially thrombosed LCIA and so may have been excluded in practice*.

The exclusions

The scoring system found 9 cases to be unsuitable for fEVAR prior to any subanalysis of the dissection features (2 dissections and 7 non dissections) and on subanalysis of the dissections we found 20 dissections to be unsuitable for fEVAR. Overall we would have excluded 7 non dissections + 20 dissections+ 1(*case mentioned above with a partially thrombosed LCIA), a total of 28 cases (40%).

Discussion

The aim of this study was to assess a single-centre experience in the endovascular management of TAAA and hence to determine the proportion of TAAAs which might be suitable for pure endovascular repair i.e. fenestrated or branched stent grafting, based on aneurysm morphology. In order to quantify the issues which render a case suitable/unsuitable for fEVAR, we devised a scoring system. The scoring system was based on those morphological features which present the **most** difficulty to the operator. For the score to be of any value it must be reproducible and as simple as possible. There are many features which also contribute to the technical difficulty of a case and these may be relevant in the ultimate assessment of the individual case, whilst not a component of the score. Such issues include calcification of the vessels, circumferential thrombus or occlusion (as in one of the cases discussed), double thoracic angulation >90°. We have also recognised that there are specific features of dissections which must be considered and for this reason the dissections were sub-analysed.

Our scoring system found that 60% of cases were suitable for pure fEVAR using current technology. Adverse anatomy renders approximately 40% of TAAA presenting to our unit, challenging for endovascular repair. However, fEVAR may be technically possible requiring longer imaging times, larger contrast volumes and longer operation times. The long term durability of fEVAR in these cases with multiple challenges may be compromised.

Of the features assessed, aortic arch and descending thoraco-abdominal aortic angulations of $\leq$90° were common 27% and 24% respectively. Furthermore 47% of cases had a tortuous descending thoraco-abdominal aorta with a double bend regardless of acuity. The angulated neck does present a significant clinical problem. The correct measurements may have been taken for graft planning and production from the MDCTA, but in practice it can be very difficult to orientate the graft in angulated necks. Subsequently the graft may not sit properly in the neck leading to malalignment after deployment and resulting in cannulation difficulties. Visceral ostial stenosis will exacerbate any such cannulation difficulties. Celiac access ostial stenosis was present in 31% of cases, although the SMA was only significantly stenosed in 7% of cases. The renal vessels were stenosed in 24% and 19%, left and right respectively. Landing zone lengths, iliac tortuosity and EIA diameter were much less of an issue. Aortic angulation and visceral vessel stenosis were the main areas of difficulty. Within the dissection group, the true lumen diameter was the most common difficult feature.

We extensively assessed our cases to derive the described scoring system and consider this an important step in the feasibility analysis of these cases. We plan to validate this scoring method by applying it to a prospective cohort of patients and so determine whether such anatomical factors influence choice of procedure and the difficulty encountered during the procedure in clinical practice.

The field is evolving and progress in stent design and technology will enable a higher proportion of patients with TAAA to undergo endovascular therapy. Low profile delivery devices are desirable, but we have shown that improved stent conformability and steerability are vital if we are to treat more complex cases. Low profile accessory balloon expandable stents and balloons enable treatment of the visceral vessels and Sadeghi *et al*. are exploring the use of balloon inflatable catheter tips to prevent visceral embolisation.[25]

In-situ fenestration may be an option where orientation of the device may be unpredictable due to severe angulation or confined space. Intra-operative dynaCT offers dynamic cross-sectional imaging which may improve technical success, particularly in challenging cases.[26] Adjuvant technology such as dedicated IVUS or robotic technology may aid the cannulation in difficult anatomy.[27,28]

Table 5 Summary of individual component analysis.

	All Cases $n = 70$		Dissections $n = 26$	
Score (%)	0 (%)	1 (%)	0 (%)	1 (%)
Proximal landing zone length ($\geq/< 1.5$ cm)	69 (99%)	1 (1%)	25 (96%)	1 (4%)
Distal landing zone ($\geq/< 1.5$ cm)	66 (94%)	4 (6%) (1 occluded)	26 (100%)	0 (0%)
Aortic arch angulation ($>/\leq 110^\circ$)	51 (73%)	19 (27%)	19 (73%)	7 (30%)
Thoraco-abdominal aorta angulation ($>/\leq 90^\circ$)	56 (76%) (18 double angles)	17 (24%) (15 double angles)	17 (65%) (6 double angles)	9 (35%) (8 double angles)
Left subclavian artery origin stenosis ($</\geq 50\%$)	65 (93%)	5 (7%)	23 (88%)	3 (12%)
Celiac axis origin stenosis ($</\geq 50\%$)	48 (69%)	22 (31%)	23 (88%)	3 (12%)
Superior mesenteric artery origin stenosis ($</\geq 50\%$)	65 (93%)	5 (7%)	26 (100%)	0 (0%)
Left renal artery origin stenosis ($</\geq 50\%$)	53 (76%) (1 double vessels)	17 (24%) (2 double vessels)	20 (77%) (1 double vessels)	6 (23%) (0 double vessels)
Right renal artery origin stenosis ($</\geq 50\%$)	55 (79%) (4 double vessels)	15 (19%) (1 double vessels)	21 (80%) (2 double vessels)	5 (19%) (0 double vessels)
Left common iliac artery tortuosity ($>/\leq 70^\circ$)	61 (87%*) (10 double angles) (1 partially thrombosed) +*1 vessel occluded	8 (11%*) (5 double angles)	23 (88.5%) (4 double angles) (1 partially thrombosed)	3(11.5%) (3 double angles)
Right common iliac artery tortuosity ($>/\leq 70^\circ$)	64 (91%**) (6 double angles) +**1 vessel occluded	5 (7%**) (3 double angles)	25 (96%) (0 double angles)	1 (4%) (1 double angles)
Left external iliac artery ($>/\leq 7$ mm)	61 (87%)	9 (13%)	26 (100%)	0 (0%)
Right external iliac artery ($>/\leq 7$ mm)	60 (86%)	10(14%)	25 (96%)	1 (4%)

* 1 vessel and ** 1 vessel occluded hence % not = 100, * and ** are in the same case.

The manufacturing of a bespoke graft limits the clinical application of fEVAR to urgent cases and "off the shelf" designs are required. Interestingly Chuter *et al*. found that 88% of cases normally treated with custom made grafts could have been treated with a standard off the shelf stent.[4]

The development of a scoring system enables the clinician to objectively analyse these cases and this in turn will

Table 6 Score results.

	No of total (%)		No of dissections (%)		
Difficulty Score	Number in each score category ($n = 70$)	% of total no of cases ($n = 70$)	Number in each score category ($n = 26$)	% of total no of dissections ($n = 26$)	% of total no in each score category with dissections
0	12	(17%)	7	27%	58% ($n = 12$)
1	20	(29%)	7	27%	35% ($n = 20$)
2	14	(20%)	7	27%	50% ($n = 14$)
3	15	(21%)	3	11.5%	20% ($n = 15$)
4	5	(7%)	2	7.5%	40% ($n = 5$)
5	1	(1%)	0	0%	0% ($n = 2$)
6	2	(3%)	0	0%	0% ($n = 2$)
7	1	(1%)	0	0%	0% ($n = 1$)
Total Excluded	9 (13%)		2	8%	N/A

Table 7 Dissection subanalysis.

Dissection Subanalysis (n = 24)				
Feature	Parameter	No		
True Lumen	≥26 mm	14		
	<26 mm	10 (excluded)		
SMA origin	True Lumen	18		
	False Lumen	4 (excluded)		
	Both	2		
Visceral origin (no from false Lumen)	0	12 (50%)	<2 from False lumen	18
	1	6 (25%)		
	2	3 (12.5%)		
	3	1 (4%)	>2 from False lumen	6 (excluded)
	4	2 (8%)		
	5	0 (0%)		
Commom Iliacs Diameter	≤24 mm	20		
	>24 mm	4 (3 unilateral, 1 both) (excluded)		

focus the technological developments required to further develop this exciting field.

Conflict of Interest/Funding

None.

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